

MSCR Implementation Across the Country: A Progress Report

**PCCAS Binder Committee Meeting
Reno, NV
March 24, 2015**

**Mark Buncher
Mike Anderson**

- DTFH61-11-H-00033
 - Cooperative Agreement between the FHWA and the Asphalt Institute
 - Michael Arasteh, AOTR
 - John Bukowski, Subtask Leader
- User Agencies
- Member Companies of the Asphalt Institute

- AI's Guidance
- Status
 - NEAUPG
 - SEAUPG
 - NCAUPG
 - RMAUPG
 - PCCAS
- Variability
- Observations

- **Disclaimer:** While care has been taken to provide the most accurate and current information, users are warned that there may be inaccuracies and recent revisions may not be reflected. To ensure the most accurate information, the particular State agency should be contacted.

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MSCR Information

[MSCR Implementation Database](#)

Free Webinar:

[Understanding the MSCR Test and its Use in the PG Asphalt Binder Specification](#)

Guidance Documents

[AI's Guidance Document on MSCR Implementation \(PDF 419 kb\)](#)

[AI's Guidance Document on using MSCR with AASHTO M320 \(PDF 344 kb\)](#)

[FHWA Tech Brief on the MSCR Procedure \(PDF 771 kb\)](#)

[SEAUPG – Use of MSCR to Replace PG Plus Tests \(PDF 44 kb\)](#)

[SEAUPG – Guidance for Evaluation of MSCR Recovery to Replace PG Plus Tests \(PDF 83 kb\)](#)

Research Papers

[NEAUPG MSCR ILS Final Report with Appendix \(PDF 1.1 mb\)](#)

[SEAUPG MSCR ILS Final Report with Appendix \(PDF 476 kb\)](#)

Presentations

[Why We Need MSCR \(PDF 1.89 mb\)](#)

2012 SEAUPG Annual Meeting

[Evaluation of Jnr Criterion for Unmodified Asphalt Binders \(PDF 1mb\)](#)

[SEAUPG Evaluation of MSCR Recovery as a Replacement for PG Plus Tests \(PDF 575 kb\)](#)

[Binder Task Group – Multiple Stress Creep Recovery \(MSCR\) Task Force Overview and Recommendations \(PDF 282 kb\)](#)

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“It is the Asphalt Institute’s opinion that the MSCR test and specification represent a technical advancement over the current PG specification that will allow for better characterization of the high temperature performance-related properties of an asphalt binder.”



Asphalt Institute Guidance Document

Implementation of the Multiple Stress Creep Recovery Test and Specification

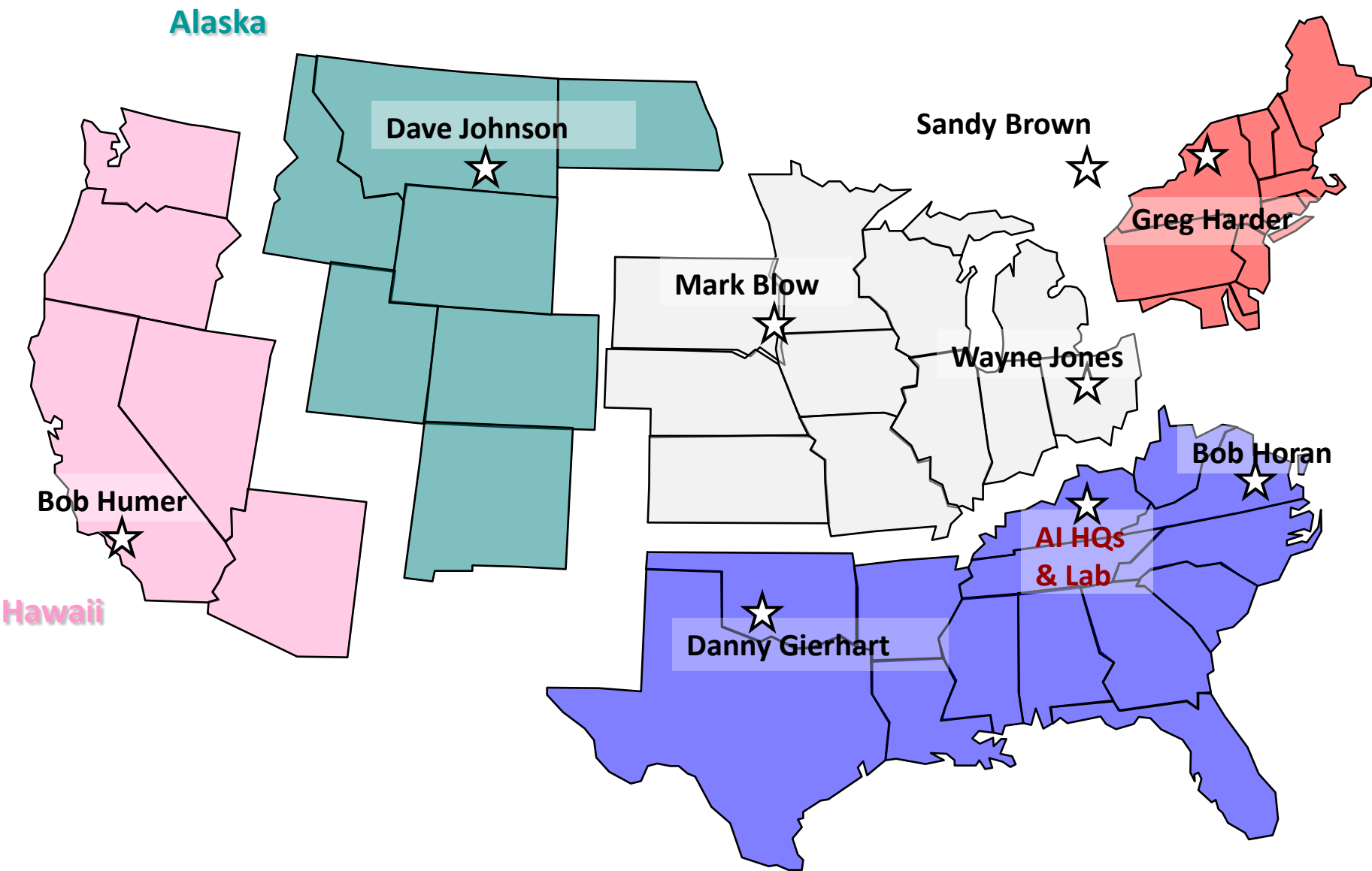
The purpose of this document is to provide guidance to the asphalt industry, users and producers, regarding the implementation of the new high temperature binder test and specification using the Multiple Stress Creep Recovery (MSCR) test. The MSCR test replaces the existing AASHTO M320 Dynamic Shear Rheometer (DSR) test used for characterizing the high temperature performance properties

of an asphalt binder after short-term aging. It is the Asphalt Institute's opinion that the MSCR test and specification represent a technical advancement over the current PG specification that will allow for better characterization of the high temperature performance-related properties of an asphalt binder.

Our Message Has Been...

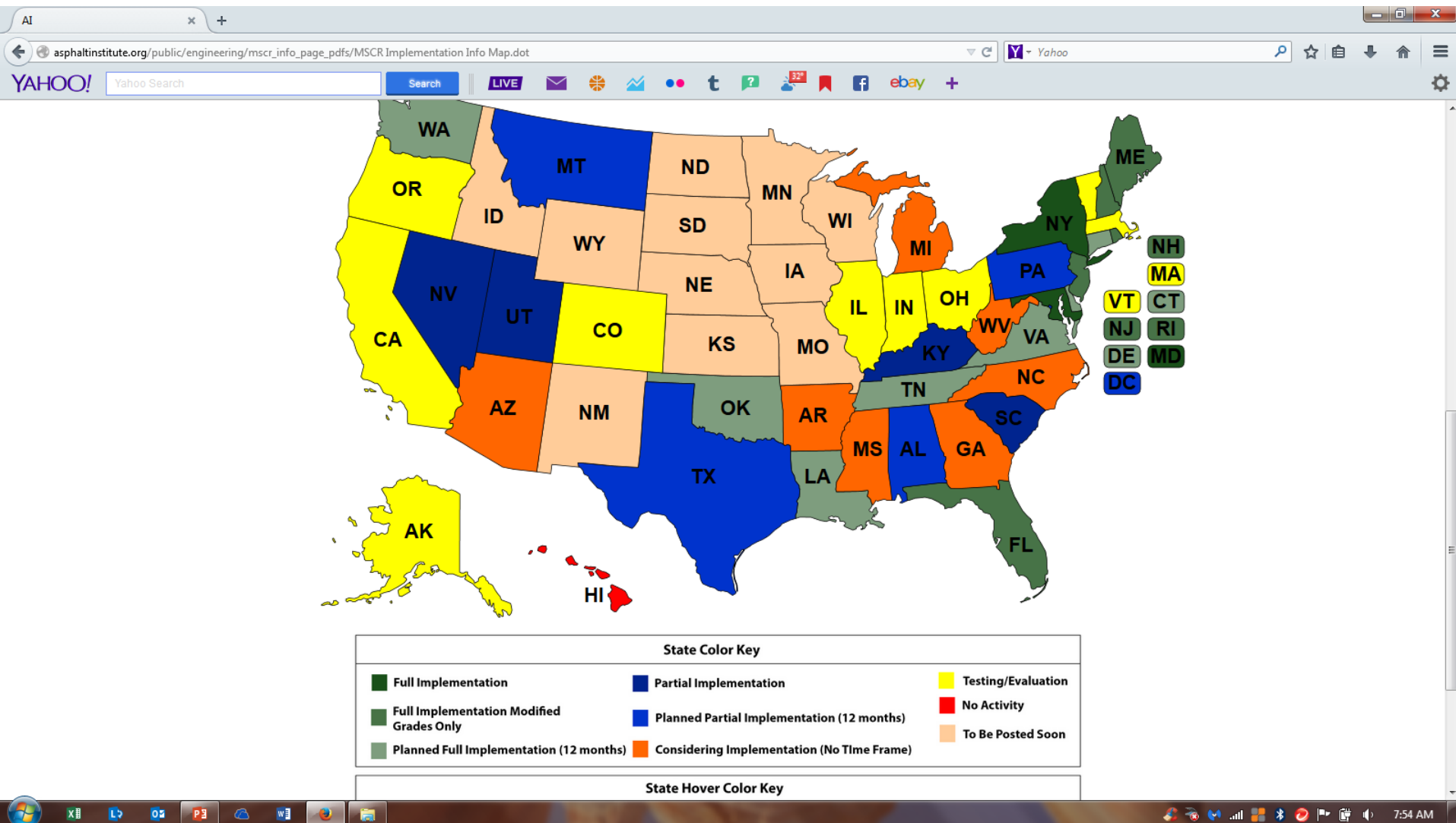
- AI recommends that States move toward implementing full MSCR (AASHTO M 332)
- Use of % Rec only as a PG+ test (to replace an existing PG+ test) can be good first step
- Accomplish regionally by working together with other States in the UPG
- Goal is consistent specs!
 - Use M 332 for criteria, grade designations
 - If % Rec only as PG+ test, then still M320
- Reduce spec proliferation

AI Regional Engineer (“Field”) Offices and User Producer Groups





State MSCR Implementation Database



Northeastern Asphalt UPG (NEAUPG)



- NEAUPG leads the nation in MSCR implementation
- NEAUPG agreed to uniform implementation of MSCR in 2013 using M 332 grade designations by all States
- While not all NEAUPG States have fully implemented M 332 at this time, all states have agreed to stick with this (including using the curve for % Rec)
- Many NEAUPG suppliers have been supplying M 332 binders for quite some time
- Many suppliers are showing both M 320 (old) and M 332 (new) grade designations on their shipping documents

- NY, MD, CT – fully implemented for all grades
- NH, ME, RI, NJ – fully implemented for modified grades only
- PA will begin allowing a substitution of PG 64E-22 in 2015
- MA doesn't normally use modified binders – lab getting up to speed
- DE allows substitution of PG 64E-22 – will fully implement modified binders in 2015
- VT doesn't use any modified materials – is currently testing binder using MSCR – no plans yet to implement – waiting for the rest of New England states
- DC is planning to implement for all grades in 2015

AI's MSCR Implementation Database - NY

http://www.asphaltinstitute.org/wp-content/uploads/public/engineering/mscr_info_page.pdf/mscr_implementation_database.pdf/ny-0714.pdf asphaltinstitute.org

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Details:

NYSDOT has been testing their binders using MSCR since 2011. Two Engineering Bulletins (EB) have been written and approved by the dept. - effective 5/14/14. The first EB will allow the substitution of MSCR graded binders (M332) on all existing contracts provided there is no additional cost to the dept. The second EB is for the designers to specify the use of MSCR (M332) graded binders in all new contracts scheduled for letting after Sept. 4, 2014 and for all contracts prior to Sept. 4 but before the contract amendment deadline.

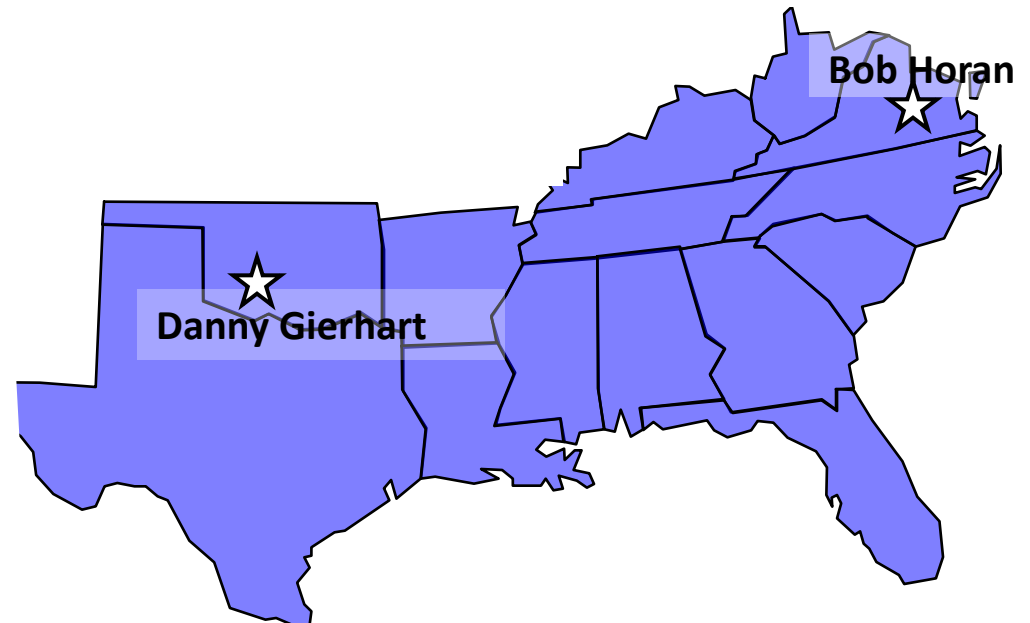
Current M320 Grade	M332 Grade <i>or</i> (Test Temp. °C)	MSCR			Implementation	
		Requirement				
		Jnr _{3,2} (kPa ⁻¹)	Jnr _{diff} (%)	% Rec _{3,2}		
PG 76-22	PG 64E-22	0.5 max.	75 max.	<i>see note below</i>	Sept. 2014	
PG 70-22	PG 64H-22	2.0 max.	75 max.	n/a	Sept. 2014	
PG 64-22P	PG 64V-22	1.0 max	75 max.	<i>see note below</i>	Sept. 2014	
PG 64-22	PG 64S-22	4.5 max.	75 max.	n/a	Sept. 2014	
PG 58-34	PG 58E-34	0.5 max	75 max.	<i>see note below</i>	Sept. 2014	

Notes:

For $Jnr \geq 0.1$, $\% Rec_{3,2} > 29.371 Jnr_{3,2}^{-0.263}$; For $Jnr < 0.1$, $\% Rec_{3,2} > 55\%$

Done

Southeastern Asphalt UPG (SEAUPG)



- MSCR Task Force formed in late 2010
 - Members: all 14 states, binder suppliers, 3 DSR manufacturers, 2 commercial labs
 - Chaired by Don Siler, facilitated by AI
 - Purpose:
 - move evaluation of MSCR test and specification forward
 - provide guidance, info and resources to states
 - identify and address barriers to implementation
 - conduct MSCR ILSs
- Held approximately 20 WebEx meetings over last 4 years
- Progress slow but steady
 - Test temp at either 64 or 67 (AL, GA, LA, FL, MS)
 - Peer pressure among States

- VA, OK, FL, LA fully implemented M 332 for all grades
 - Also replaced PG-Plus tests with MSCR Recovery
 - FL and LA sticking with M320 grade designations
- KY, SC, TN replaced PG-Plus test with % Rec
 - Criteria different for each (“curve” vs min. value)
- AL “probably” going to full M 332 and % Rec
- TX “probably” going to % Rec
- GA currently uses Jnr and % Rec for GTR only
- MS, NC, WV, AR “considering” implementation of some form, but currently lag behind other States

- Different criteria being adopted
 - % Rec: curve vs. tiered approach vs. minimum without being tied to J_{nr}
 - Still a huge improvement over Elastic Recovery
- Grade designations when fully adopting M 332
 - Some states (LA and FL) sticking with M 320 grade designations (i.e. PG 76-22)
 - Primary reason: avoid confusion and the “major task” of a name change
 - This practice could spread to other regions of the country
 - Other states (OK and VA) are using M 332 grade designations (i.e. PG 64E-22)
- New focus needs to be on consistency of adoption

North Central Asphalt UPG (NCAUPG)



- CSBG States make up the NW segment of the NCAUPG (ND, SD, NE, IA, MN, WI)
 - central reporting system for supplier test results
 - one standard process to be a certified supplier in all six states
 - Participation in quarterly “Round Robin” program
 - Daily requirements
 - Bi-weekly requirements
- Predominately a 58 and 64 region
 - with a northern 52 area

- In 2014, CSBG States agreed to adopt % Rec in lieu of Elastic Recovery
 - Intended to go into effect in 2015
 - Nebraska not until July 2015 or later
 - % Rec minimum based on M 320 grade
- CSBG also agreed to move towards full implementation of M 332 in 2016
 - AI will work with the six States to hold regular WebEx meetings with industry participation
 - Need to map M 320 grades over to M 332 grades

CSBG Criteria for Min. % Rec in 2015

AASHTO M320 Grade	Test Temperature	
	58°C	64°C
52-34	0	0
58-28	0	0
64-22	0	0
58-34P	30	25
64-28P	30	25
64-34P	55	45
70-22P	55	45
70-28P	55	45
70-34P	75	75
76-28P	75	75
76-34P	75	75
82-22P	75	75

Will reevaluate limits in 2016

Roadblock for CSGB – Lots of Grades

2014 grades utilized in the CSBG

	IA	MN	NE	ND	SD	WI
46-34		U				B
52-34	U	B	U			
58-28	U	U		U	U	B
58-34(P)	M	B	M	M	M	B
64-22	U	U			U	B
64-28(P)	M	B		B	M	B
64-34P	M	M	M	M	M	B
70-22P	M					
70-28P	M	M		M		
70-34P	M		M			

M = Modified

U = Unmodified

B = Both modified and unmodified versions

10 grades utilized

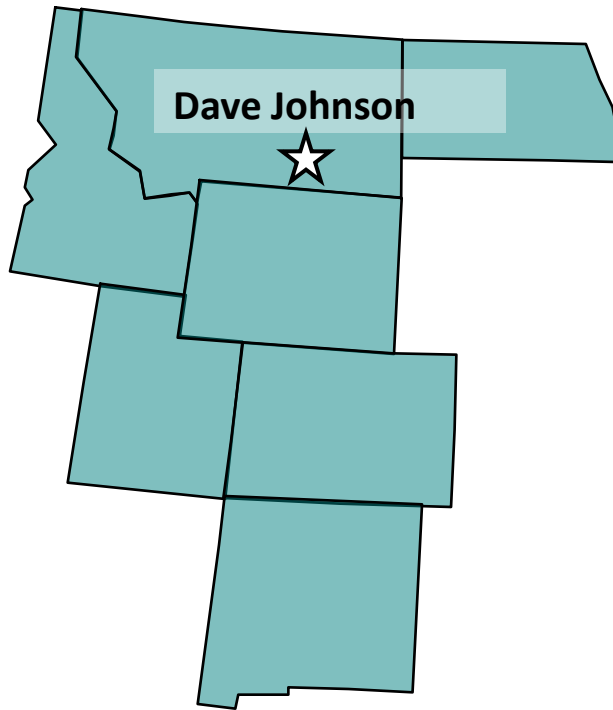
- 4 unmodified
- 4 polymer modified
- 2 either unmodified or polymer modified

- North Dakota uses highly modified binders (PG70) to combat heavy loading
 - Primarily due to lack of quality aggregates
 - Typical best CAA of 80/60 on 30 M ESAL
 - PG 64-34 ruts on high volume pavements
- Nebraska makes almost exclusive use of -34's
 - To fortify extensive use of RAP
 - They just like polymer
- PG 46's & 52's primarily used in WI & MN for RAP/RAS Mixes

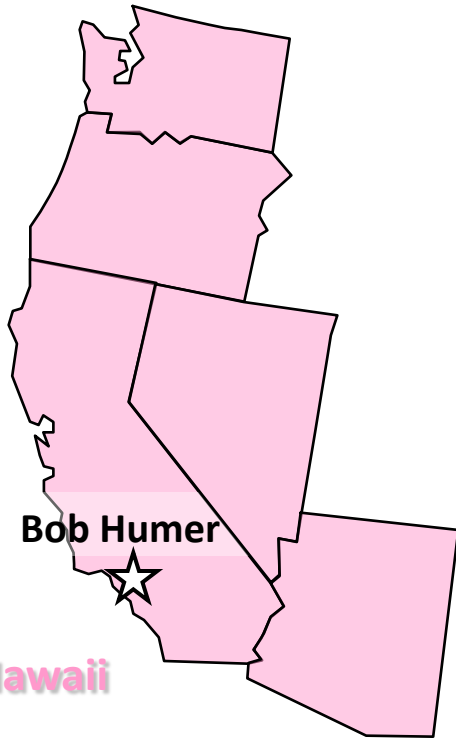
- Missouri
 - First State to adopt MP-19 grades in lieu of M 320
 - 64S-22 for 64-22, 64H-22 for 70-22, 64E-22 for 76-22
 - M 320 grades require ER; MP-19 grades don't require % Rec
- Kansas
 - Following CSBG. Shadow testing current binders
- Indiana
 - In 2nd of 3-yr research project looking at MSCR for IN
- Illinois
 - Following CSBG. May adopt % Rec as early as 2015
- Ohio
 - Following CSBG. Will likely be awhile

Rocky Mountain Asphalt UPG (RMAUPG)

Alaska



- All states still testing and evaluating through Western Cooperative Test Group (WCTG)
 - On-going round robin testing with states and suppliers
 - Analysis performed by University of Wisconsin-Madison
 - Variability still high but improving
 - Certainly for non-standard J_{nr} of 10 kPa, but even for .1 and 3.2
- Industry hesitant on implementation
 - Concern over variability
 - Higher with % Rec versus current PG-Plus tests
- No form of MSCR adoption at this time
- Exception: UT uses % Rec on micro surfacing emulsion spec, min % on residue
 - MT wants to do the same



- Several states been shadow testing for years
- Latest PCCAS ILS conducted by AI HQ
 - Report completed in mid 2014, presentation in Oct'14, variability in-line with other UPG
- MSCR/J_{nr} Task Group formed in mid-2014
 - Bob Humer appointed Chair
- First step: conducted survey of PCCAS states and suppliers regarding their position
 - Overall positive on % Rec to replace E.R. and other PG-plus tests (not in addition to)
 - Overall very concerned with variability
 - Comprehensive data collection effort for 2014 with DOTs and Suppliers, submitting M320 and M332 data
 - Analyzed and reported in March, 2015

- NV started in Jan 2014 to require test results for M 332 specs, only for their PG 76-22NV grade
- WA is furthest along
 - Plans to implement M 332 on 1/1/16
 - Including MSCR-Rec
 - No S (standard) grades, only H, V, and E grades

AI's Website: MSCR Implementation Status - WA DOT

Details: Currently using AASHTO M 320 Table 1 requirements and T 301 Elastic Recovery with a minimum 60% for PG 64-28, 70-28, 76-28 and 70-22. Plan to implement AASHTO M 332, MSCR and percent recovery specification in 2016 to replace M 320 and Elastic Recovery and only specify H, V, and E grades. Current PG 64-22 graded binder will be classified as PG 58H-22 with no percent recovery specification.

	MSCR				
Current M320 Grade	M332 Grade <i>or</i> (<i>Test Temp.</i> °C)	Requirement			Implementation
		Jnr _{3.2} (kPa ⁻¹)	Jnr _{diff} (%)	% Rec _{3.2}	
PG 76-28	PG 64E-28	0.5 max.	75 max.	40% min.	Jan. 2016
PG 70-28	PG 64V-28	1.0 max.	75 max.	35% min.	Jan. 2016
PG 70-22	PG 58V-22	1.0 max.	75 max.	35% min.	Jan. 2016
PG 64-28	PG 64H-28	2.0 max.	75 max.	30% min.	Jan. 2016
PG 64-22	PG 58H-22	2.0 max.	75 max.	n/a	Jan. 2016
PG 58-22	n/a				

Notes: No "S" (standard) grades will be specified, all PG grades will be required to meet a specification of ≤ 2.0 Jnr. Based on accumulated historical test data use of standard grades would allow softer binders than are currently utilized.

Multi-Lab Precision Estimates: AI ILS Studies



- d2s is acceptable range of two test results at 95% confidence level.
- Values shown below for UPGs are averages of multiples materials.

ILS	Multi-Lab Rec-3.2 d2s	Multi-Lab Jnr-3.2 d2s	(Neat vs. Modified)
ETG 2009	18.1%	22.0-42.6%	
NEAUPG 2010	18.7%	33.7%	
SEAUPG 2011	9.8%	28.0%	
NEAUPG 2012	7.6%	33.0%	
PCCAS 2013	17.3%	36.0%	

Note: aging is part of variability values shown above

For comparison, RTFO $G^*/\sin \delta$ (T315) has multi-lab d2s of 22.2% *

*NCHRP Web-Only Document 71 (Project 09-26), "Precision Estimates for AASHTO Test Method T308 and the Test Methods for Performance-Graded Asphalt Binder in AASHTO Specification M320"

Multi-Lab Precision Estimates: AI ILS Studies **plus AMRL PSP Data**

- AMRL PSP values shown below are from a single material tested.

ILS	Multi-Lab Rec-3.2 d2s	Multi-Lab Jnr-3.2 d2s
ETG 2009	18.1%	22.0-42.6%
NEAUPG 2010	18.7%	33.7%
SEAUPG 2011	9.8%	28.0%
NEAUPG 2012	7.6%	33.0%
PCCAS 2013	17.3%	36.0%
AMRL Proficiency Sample Program (2009-2011)	27.4%	45.1%
(2012-2013)	14.5%	30.1%

- Better indicator of high-temp performance
- Get rid of ductility tests
 - time, space, money
- Better evaluates modification techniques
 - captures networking of polymer versus just presence of polymer
- Evaluates stress dependency of binders

Typical Obstacles of States to Implement MSCR



- Pain and confusion that comes with changing naming convention of grades
 - From designers to contractors to truck drivers
- Concerns regarding perceived high variability
- Confusion around concept of test temp being based on environmental temp
- No high temp performance concerns with our binders...why change?

- Definite overall progress towards MSCR last few years
- States want same binders
 - same polymer content
- Mapping from M 320 to M 332 grades is not clean
 - i.e. PG 76 often becomes a 64E (not 64V)
 - Some States adding % Rec when they didn't have PG+ test before
- Renewed emphasis needed to encourage States to consistently implement MSCR using M 332
 - same grade designations
 - same criteria

Thanks!

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